CLAIMS

I claim:

1. An optical sensor assembly comprising:

a housing;

only one light source within the housing, the light source being configured to emit light predominantly of a red color; and

sensors within the housing, the sensors being configured to detect diffuse and specular reflections of the light from an object.

2. The optical sensor assembly of claim 1, wherein the housing includes a plurality of apertures against which the sensors are coaxially aligned, the apertures being shaped and positioned relative to the sensors to control resolution and energy collection of the sensors.

3. The optical sensor assembly of claim 1, wherein the plurality of apertures are elongated slots that have substantially orthogonal longitudinal axes.

4. The optical sensor assembly of claim 2, wherein the plurality of apertures include a diffuse reflection collecting aperture aligned at an angle of 90 degrees with respect to a measured surface of the object.

5. The optical sensor assembly of claim 2, wherein the plurality of apertures include a specular reflection collecting aperture aligned at an angle of 56 degrees with respect to a measured surface of the object.

6. The optical sensor assembly of claim 1, wherein the light source is configured to emit light with a maximum intensity corresponding to a wavelength, λ, of approximately 640 nm.

7. The optical sensor assembly of claim 1, wherein the light source is a light emitting diode (LED).

8. The optical sensor assembly of claim 1, wherein the light source is aligned at an angle of 56 degrees with respect to a measured surface of the object.

9. The optical sensor assembly of claim 1, wherein the plurality of sensors are phototransistors (PTRs).

10. The optical sensor assembly of claim 1, further comprising:

a flexible printed circuit assembly (FPCA) within the housing to which one or more of the light source and the plurality of sensors are connected.

11. The optical sensor assembly of claim 10, wherein one or more of the light source and the plurality of sensors are connected to the FPCA with solder.

12. The optical sensor assembly of claim 10, wherein one or more of the light source and the plurality of sensors are connected to the FPCA with a lead-free conductive epoxy resin.

13. The optical sensor assembly of claim 10, wherein one or more of the light source and the plurality of sensors are subminiature surface mount components.

14. The optical sensor assembly of claim 10, wherein stiffening members are joined to the FPCA to control local stiffness.

15. The optical sensor assembly of claim 10, wherein the housing includes a plurality of datum surfaces and pylon members positioned against the FPCA such that the light source and the plurality of sensors are held against the datum surfaces.

16. An optical sensor assembly comprising:

a housing;

only one light source within the housing, the light source being configured to emit light predominantly of a red color; and

means for detecting diffuse and specular reflections of the light from an object.

17. The optical sensor assembly of claim 16, wherein the light source is configured to emit light with a maximum intensity corresponding to a wavelength, λ, of approximately 640 nm.

18. The optical sensor assembly of claim 16, wherein the light source is a light emitting diode (LED).

19. The optical sensor assembly of claim 16, wherein the means for detecting includes a plurality of sensors within the housing.

20. The optical sensor assembly of claim 19, wherein the plurality of sensors are phototransistors (PTRs).

21. The optical sensor assembly of claim 19, further comprising:

a flexible printed circuit assembly (FPCA) within the housing to which one or more of the light source and the plurality of sensors are connected.

22. The optical sensor assembly of claim 21, wherein one or more of the light source and the plurality of sensors are connected to the FPCA with solder.

23. The optical sensor assembly of claim 21, wherein one or more of the light source and the plurality of sensors are connected to the FPCA with a lead-free conductive epoxy resin.

24. The optical sensor assembly of claim 21, wherein one or more of the light source and the plurality of sensors are subminiature surface mount

components.

25. The optical sensor assembly of claim 21, wherein a local stiffness (flexural modulus) of the FPCA is controlled with stiffening pads joined to the FPCA and/or with holes formed through the FPCA.

26. The optical sensor assembly of claim 21, wherein the housing includes a plurality of datum surfaces and pylon members positioned against the FPCA such that the light source and the plurality of sensors are held against the datum surfaces.

27. An optical sensor assembly comprising:

a housing;

a light source within the housing; and

sensors within the housing, the sensors being configured to detect diffuse and specular reflections of the light from an object, with no lenses being positioned between the sensors and the object.

28. The optical sensor assembly of claim 27, wherein the housing includes datum surfaces against which the source of light and the plurality of sensors are positioned.

29. The optical sensor assembly of claim 27, further comprising:

means for positioning the source of light and the plurality of sensors against the housing.

30. The optical sensor assembly of claim 29, wherein the means for position includes a flexible printed circuit assembly (FPCA) to which the source of light and the plurality of sensors are mounted and pylon members through which the FPCA is threaded within the housing.

31. The optical sensor assembly of claim 27, wherein the source of light

is a light emitting diode (LED).

32. The optical sensor assembly of claim 27, wherein the sensors are phototransistors (PTRs).

33. The optical sensor assembly of claim 27, wherein the sensors are configured for operation at a working distance of 2.2mm ± 0.5mm between the housing and the object.

34. The optical sensor assembly of claim 33, wherein the sensors are configured to have fields of view no greater than 2.5mm at the working distance.

35. The optical sensor assembly of claim 27, wherein the sensors are configured to have ellipse-shaped fields of view with respect to the object.

36. The optical sensor assembly of claim 35, wherein major axes of the ellipse-shaped fields of view are approximately orthogonal to each other.

37. An optical sensor assembly comprising:

a housing;

a flexible printed circuit assembly (FPCA) within the housing;

light source and optical sensor components secured to the FPCA; and

means for altering a stiffness modulus at discrete positions along the FPCA.

38. The optical sensor assembly of claim 37, wherein the housing is formed with a plurality of pylon members configured to impart forces against the FPCA anchoring the light source and optical sensor components against the housing.

39. The optical sensor assembly of claim 37, wherein the FPCA is made of a polyimide material.

40. The optical sensor assembly of claim 37, wherein the FPCA is made of a polyester material.

41. The optical sensor assembly of claim 40, wherein the polyester material is based on Polyethylene Terephthalate (PET).

42. The optical sensor assembly of claim 37, wherein the light source and optical sensor components are secured to the FPCA with connectors built directly on the FPCA.

43. The optical sensor assembly of claim 37, wherein the means for altering a stiffness modulus include one or more stiffening pads positioned on opposites sides of the FPCA from the light source and optical sensor components.

44. The optical sensor assembly of claim 43, wherein the housing includes a plurality of pylon members configured such that the stiffening members fit between the pylons.

45. The optical sensor assembly of claim 37, wherein the means for altering a stiffness modulus include one or more holes formed through the FPCA.

46. The optical sensor assembly of claim 45, wherein the one or more holes are positioned along the FPCA between the light source and optical sensor components.

47. An optical sensor assembly comprising:

a housing;

a flexible printed circuit assembly (FPCA) positioned within the housing, the FPCA being made of a polyester material; and

light source and optical sensor components secured to the FPCA.

48. The optical sensor assembly of claim 47, wherein the polyester material is based on Polyethylene Terephthalate (PET).

49. The optical sensor assembly of claim 47, wherein one or more of the light source and optical sensor components are soldered to the FPCA.

50. The optical sensor assembly of claim 47, wherein one or more of the light source and optical sensor components are secured to the FPCA with a conductive epoxy resin.

51. The optical sensor assembly of claim 50, wherein the conductive epoxy resin is lead-free.

52. The optical sensor assembly of claim 47, wherein one or more of the light source and optical sensor components are secured to the FPCA with a non-conductive connecting material.

53. The optical sensor assembly of claim 52, wherein the non-conductive connecting material is an cyanoacrylate glue.

54. The optical sensor assembly of claim 47, wherein the FPCA includes metal traces.

55. The optical sensor assembly of claim 54, wherein the metal trace include copper.

56. The optical sensor assembly of claim 47, wherein the FPCA includes conductive ink traces.

57. An imaging device comprising:

an optical sensor including

a housing,

only one light source within the housing, the light source being configured to emit light predominantly of a red color, and

sensors within the housing, the sensors being configured to detect diffuse and specular reflections of the light from an object; and

means for scanning the object with the optical sensor.

58. An imaging device comprising:

an optical sensor including

a housing,

a light source within the housing, and

sensors within the housing, the sensors being configured to detect diffuse and specular reflections of the light from an object, with no lenses being positioned between the sensors and the object; and

means for scanning the object with the optical sensor.